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Enhancing the Impact of Agricultural Research: An Impact Pathway Perspective

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Assessing the impact of agricultural research often implies proving that some kind of positive impact was (or could be) achieved as a result of a successful research operation. This paper suggests an alternative approach: one that assumes from the outset that impact is achievable, but that stresses the importance of planning research in order to orient it more towards those areas where it is most likely to produce the highest levels of im-pact. Impact evaluation alone, although important, is not enough—it is just one element of an organization's overall orientation towards achieving impact.

The various issues surrounding impact evaluation are discussed and the concept of impact pathways is introduced to explain how impact is generated. Increasing the impact orientation of an organization involves not only understanding how impact is achieved, but also applying simple tools to ensure that research remains directed towards the overall goal of achieving Impact. Such tools include, for example, sensitizing and training researchers in relation to impact, incorporating impact criteria in project evaluations, ensuring that the results of impact evaluations are used in future research planning, integrating impact evaluation into existing planning and monitoring exercises, ensuring that project staff adopt an impact-oriented approach, and encouraging external feedback from farmers and other stakeholders. It also implies identifying those areas in which research is unlikely to be of value because various constraints reduce its potential impact.

The paper concludes with recommendations for ways in which researchers and research administrators can plan and carry out research activities in order to produce the highest possible levels of impact.

Introduction

In recent years, the beneficial role of agricultural research has been increasingly questioned, and agricultural researchers have faced ever more vocal demands for increased accountability and a more accurate consideration of the impact of their work. For example, agricultural productivity and development in many countries in sub-Saharan Africa has not improved despite many years of intensive regionwide research efforts. As a result, critics have questioned whether scientific solutions developed in agricultural research stations are really relevant to the rural poor, or whether alternative means of fostering agricultural change (e.g., through investments in rural education, marketing, or infrastructure), might be more effective.

Investment in agricultural research is usually justified by analyzing its impact in some way. Such "impact evaluation" may take various forms, from simple to complex, and may involve inputs from several disciplines, including economics, sociology, and management. The evaluation of agricultural research has typically been dominated by considerations of its economic effect on agricultural production and productivity.

However, too much emphasis on *measuring* impact and too little on identifying those areas in which it is most likely to be achieved may partly explain why agricultural research may fail to meet expectations. Perhaps for this reason, impact evaluation has been the focus of much recent discussion (e.g., Springer-Heinze et al. 2003; Engel and Carlsson 2002; Schacter 2002; Smutylo 2001; Mayne 1999; Alex 1998). In the light of such discussions, the Technical Advisory Committee of the Consultancy Group on International Agricultural Research (CGIAR), has called for a change in the way in which agricultural research organizations approach the question of research impact. The Committee has argued that not only must the fundamental nature of the research process be understood, but also the probability of achieving significant impacts must be evaluated (TAC 2000).

In this paper, an approach termed "impact orientation" is presented that is primarily concerned with targeting

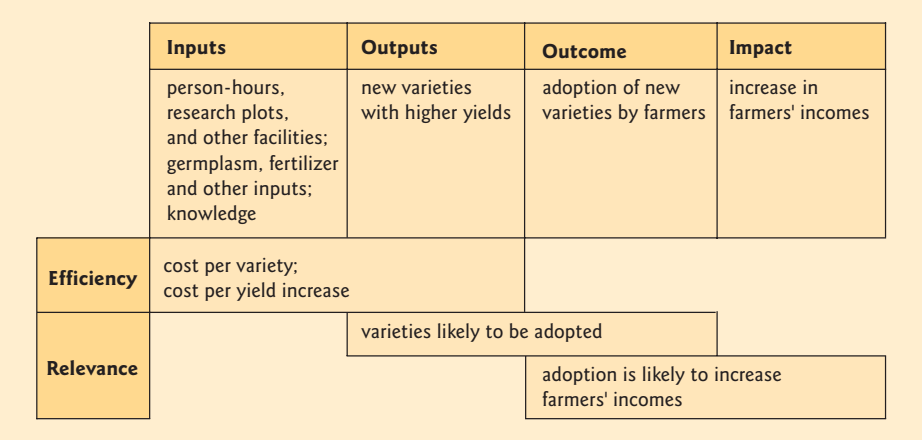
agricultural research funds at those areas in which the greatest impact is likely to be achieved. Adopting this approach should allow researchers and administrators not only to better measure the impact of their operations, but also to better orient their work towards the most appropriate areas. Such "impact orientation" can be achieved relatively rapidly by using a range of impact evaluation tools that do not necessarily involve complex measures of economic returns. In countries with limited funding and capacity for sophisticated impact assessment, simple tools for both the evaluation of impact and for increasing organizational orientation towards it can make a considerable difference. Increasing the impact orientation of an organization implies changing its culture, programs, and projects: both the planning and execution of research should become more participatory and self-reflecting—and hence better oriented towards producing positive impacts.

This paper is divided into four sections. Section 1 introduces various issues associated with "impact" and its evaluation, while section 2 uses an example from East Africa to discuss the extent to which research organizations are impact oriented. In section 3, the impact pathway is introduced as a concept for helping to increase the impact orientation of organizations. Section 4 concludes with a number of practical recommendations regarding ways in which research organizations can increase their impact orientation.

agricultural research therefore involves examining both the "instrument" itself and the evidence of its impact.

The evaluation of agricultural research usually involves measuring the resources used (inputs) and activities completed (outputs), as well as assessing the extent to which the outside world has adopted outputs and have produced economic, social, or environmental effects (i.e., impact). It may also involve tracking the efficiency with which inputs have been transformed into outputs and—more difficult to measure—into outcomes and impacts. The *relevance* of the research should also be addressed, i.e., the extent to which outputs have been created in fields in which outcomes and impact are likely to be greatest. As an example, figure 1 indicates some suitable evaluation criteria for research on new banana varieties.

Figure 1. An example of evaluation criteria in agricultural research—development of new banana varieties



1. Impact and Evaluation Issues in Agricultural Research

"Impact" is the effect of one phenomenon on another. In the context of agricultural research it often refers to the intended and/or unintended social, economic, environmental, institutional or other changes that result from research activities (Horton and Mackay 1998).

Various factors that contribute to change (and/or limit or accelerate change) can interact to produce impacts on agriculture. Such factors include knowledge, technology, education, land, capital resources, markets, policies, infrastructure, communication channels, development strategies and various others. Cultural habits and behavioral characteristics (e.g., risk aversion and entrepreneurial zeal) are also important, since they determine if and how people apply and use the results of research. Hence research alone is neither a necessary nor a sufficient condition to produce change in agriculture. Nevertheless, if other factors are favorable, research can exert considerable influence.

Any consideration of impact usually involves addressing the issue of its evaluation. Agricultural research can be viewed as an instrument for achieving various economic, social, and environmental goals: it is a means to an end. Evaluation of

The literature relating to the impact of agricultural research has concentrated mainly on the methods used to evaluate it. In this paper, impact evaluation is taken to include all methods that can contribute to our understanding of how impact is achieved. Evaluating the impact of agricultural research is problematic, and there is considerable disagreement as to which methods are best. Possible problems include the following:

- It is often difficult to establish a cause and effect relationship between research and impact. Since many factors interact to create impact, it can be hard to determine the contribution of any particular program or project. Furthermore, the causal link between research and subsequent results becomes weaker as one moves from outputs, through intermediate outcomes, to final impact.

- It is difficult to predict if and when an impact will occur. Often it occurs only many years after the completion of a project—for example, when conditions favouring uptake of the results improve.

- Different types of research create different challenges for the evaluation and measurement of impact. For example, the impact of plant breeding programs can be established by analyzing the effects on farmers of adopting higher-

yielding varieties, but a very different approach is needed to assess the impact of farming systems- or socioeconomic research, where the cause-and-effect relationships are more complex (socioeconomic research, for example, can lead to better understanding of the effects of policies, policy makers then applying this knowledge [for example, by implementing policies that induce changes in farmers' cropping patterns], which in turn produces more stable agricultural production, etc.). Since different types of research require different approaches to their evaluation, the results are not necessarily comparable.

- The inclusion of impact-linked indicators in evaluation assessments implies that research projects will be judged on the basis of effects far beyond the control of researchers and administrators. Understandably, it is difficult for institutions to accept such evaluations.

- Budgets for impact evaluation are generally limited, particularly now, when overall funding for agricultural research is in decline. Since satisfactory evaluation procedures are often very costly, research managers tend to use simpler methods to support their decision-making processes.

As mentioned earlier, a variety of methods are currently used for impact evaluation. Such methods may be quantitative, qualitative, or a combination of both; they may adopt an ex ante perspective (i.e., they assess the *likely* impacts of future research) or they may be ex post (i.e., they evaluate the impact of *completed* research projects). Some important methods of impact evaluation are listed in box 1.

When choosing an evaluation tool, research administrators commonly use the following criteria (1) the cost of the method, (2) its comprehensibility (i.e., ease of understanding) and applicability (in terms of data requirements and the human resources available to carry it out), and (3) its theoretical validity (ability to provide evidence that is firmly based on a sound theoretical framework). Figure 2 indicates the relationship between these three factors, assuming that costs increase disproportionately with increasing theoretical complexity. Figure 2 implies that it is not optimal to maximize theoretical complexity (i.e., to carry out very sophisticated impact evaluation studies). The optimal method should instead be comprehensible, applicable and affordable (see also Balzer and Nagel, 2000).

2. The Need for Impact Orientation

Adopting an impact oriented approach in research implies that contributing to development goals becomes a core concern at all levels of the research process. All decisions relating to the management and conduct of research should be made with a view to enhancing the likelihood of achieving significant positive impacts.

However, close examination of the way in which research is usually planned reveals that there is often a lack of understanding of the conditions that transform innovations into impact. Researchers often make unwarranted assumptions concerning the likely adoption of their research results. They

Box 1: Methods for Evaluating Impact

- **Economic impact assessment.** This approach is based on the economic theory of the agricultural production process: as a result of innovations produced by research, agricultural production undergoes technical change, and both income and welfare improve as a result.

- **Social impact assessment.** This assesses the effect of research on social, institutional, and individual behavior.

- **Institutional impact assessment.** This method is concerned with assessing internal learning and capacity building processes within organizations.

- **Peer and program review.** Such reviews consist of judgments of the scientific merit of research by other scientists working in, or close to, the field of research being evaluated.

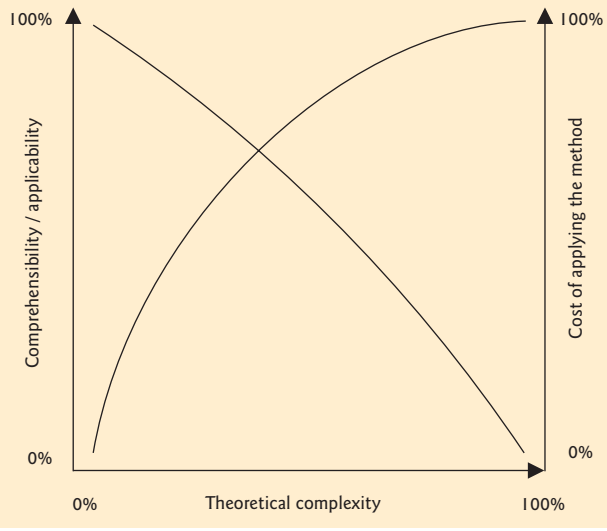
- **Studies of adoption.** These are concerned with monitoring the rate of uptake of innovations at the user level. They can also be used to evaluate the likely rate of adoption ex ante.

- **Impact mapping.** This approach monitors the effects of research by creating visual maps of the logical connections leading to impact.

- **Process monitoring and evaluation.** Analyses of this type are primarily concerned with managerial performance.

- **Impact monitoring and logical framework.** These are planning tools that permit continuous assessment of both project activities in the context of implementation schedules and the use of project outputs by targeted populations.

Figure 2. The relationship between theoretical complexity, comprehensibility/applicability and the cost of impact evaluation methods



Box 2: A Hypothetical Example: The Impact of Banana Research

The following hypothetical case, based on experience with banana research in east Africa, illustrates the difficulties associated with impact orientation.

A research organization in east Africa invested heavily in research on a new banana variety that grew well in the nutrient-deficient soils of a particular region of the country. After a decade of research, a robust, high-yielding variety was produced and made available to farmers. Additional research provided information on appropriate agronomic techniques. This "technology package" (i.e., the variety plus the agronomic knowledge), was successfully promoted by the extension service to the farmers in the target region.

However, it subsequently became apparent that in this region, bananas were traditionally grown only for home consumption as subsistence crops to complement staple foods such as cassava and maize. Following introduction of the new technology package, banana pro- duction in the region increased considerably. The remoteness of the region, however, limited the marketing opportunities available to accommodate the increased banana supplies. Prices therefore dropped and farmers subsequently lost interest in the technology package.

Several issues arise from this example:

At the ***research stage,*** the researchers delivered a promising innovation that produced greatly increased yields. The expected impacts were not realized because adequate markets were not available. Should the researchers be blamed for the fact that the marketing channels were inadequate? Yes and no. The marketing problem should have been considered at the ***investment stage***, when the research was being planned. A feasibility study could have provided possible solutions, and collaborating with market development agencies might have ensured their implementation. Alternatively, if the probability of achieving a significant impact was too low, the research should have been reoriented, for example, towards developing banana varieties for other regions, or improving another crop where high levels of impact were more likely to be achieved.

It is possible that the improved banana variety might still make a significant impact in another region or country. If this is the case, the question of whether the original investment in the improved variety was justified would depend on the mandate of the research organization.

All of the above considerations should have been addressed by the management team; researchers can only try to ensure that such issues are considered and provide any necessary information from their experience in the field.

take for granted, for example, that an extension service will be available to disseminate their results, that farmers will invest their capital in new technology, or that markets will be able to accommodate increased supplies of agricultural produce (see also box 2).

A survey of the status of impact orientation in a number of east and central African countries (ASARECA, GTZ 2000; ECART, ASARECA, CTA, GTZ 2000) revealed the following:

- **Uncertainty with regard to how impact can be achieved.** Researchers were often uncertain as to how the results of their research would reach farmers and other beneficiaries. Often, too, the way in which different elements interact to create impact was not well understood. For simplicity, therefore, policymakers and research administrators typically requested information on adoption rates or internal rates of return. Constraints on impact that were not under researchers' control were poorly understood and were therefore not usually addressed at the research planning stage.

- **Limited knowledge of impact evaluation among the staff of research organizations.** Some countries had very few specialists with a background in rural sociology or agricultural economics, and most such specialists were generally not employed to conduct evaluation work.

- **Limited understanding of the results of impact assessment.** The socioeconomists who were typically commissioned to carry out impact evaluation were not always able to communicate their results in an easily understood manner. Hence many policymakers, research administrators, and researchers had difficulty in appreciating their results.

- **Impact studies were often conducted only to justify the use of funds.** Most of the impact studies conducted in the study region focused only on trying to prove—in one way or another—that an investment in a particular research project had been worthwhile.

- **Limited participation by research users and other stakeholders**. The orientation of research towards client satisfaction and quality service (and hence impact) was often restricted by a lack of adequate interaction with stakeholders and by limited information exchange with the ultimate users of research. Researchers often feel that their scientific knowledge makes them the best judges of farmers' needs. However, both researchers and administrators often lack sufficient on-farm experience to fully appreciate those needs.

- **Limited incentives**. Researchers had little or no incentive for taking impact orientation seriously. Unlike the number of publications, the impact of a research project was not considered either when research funds were being allocated, or in job promotion decisions.

Despite these obstacles, conditions for improving impact orientation in east-African agricultural research organizations are not unfavorable. On the contrary, a number of recent

developments favor such an orientation, including the following:

- **The increasing importance of impact as an issue.** The introduction of new schemes of accountability and good governance are forcing research administrators and researchers to use new criteria in their decisions regarding resource allocation: the likelihood of achieving significant impact is becoming a more important criterion for the support and funding of research projects by donors and government agencies. Project success is also starting to be assessed on the basis of impact.

- **The availability of new impact evaluation methods.** Conventional economic (rate-of-return) impact assessments are now being complemented by more flexible methods that can quickly provide information on both the realized impact and on how it can be improved. New evaluation methods have been introduced that are easier to understand, less demanding in terms of data, less expensive, and hence more practical for research administrators to use.

- **Increased motivation amongst researchers with respect to evaluating impact.** Since donors and other funding agencies have gradually started to include impact-related criteria in their funding decisions, researchers now have a greater incentive for addressing this issue. Interest in the topic is not limited to socioeconomists: researchers from other disciplines—particularly the natural sciences—are also eager to liberate themselves from external economic evaluations by adopting new approaches.

- **Improved conditions for agricultural development.** Many public-sector reforms have been initiated, for example decentralization, restructuring of extension, establishment of poverty alleviation frame- works, and market liberalization. In agricultural research, competitive funding schemes and measures of austerity have become the order of the day, forcing researchers to develop more relevant research projects and to conduct their activities in a more transparent way.

3. Improving Impact Orientation by Means of Impact Pathways

It is important to appreciate that impact orientation is not a magic new concept that negates the many existing approaches designed to improve research performance. Rather, it combines all manner of approaches that can improve the conduct and relevance of research, and unites them via an impact-oriented perspective. In this respect, all of the developments mentioned in section 2 are welcome ways of encouraging increased impact orientation.

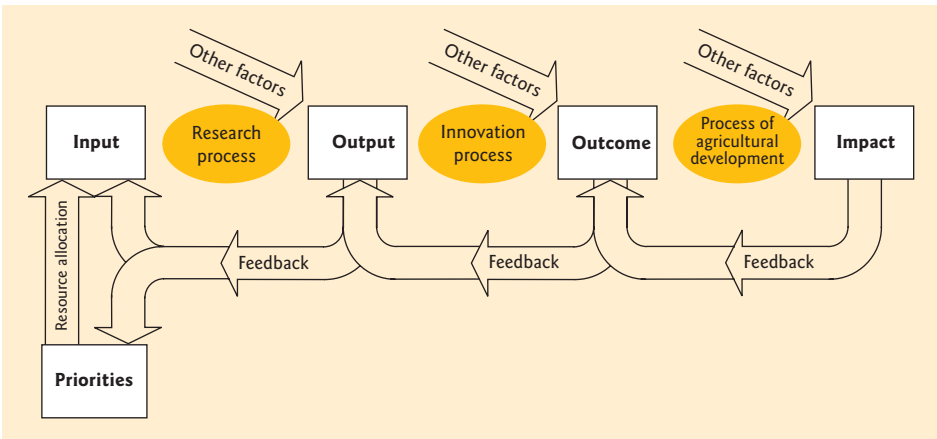
Organizations aiming to become more impact oriented can also employ the impact pathway concept. The purpose of this perspective is to re-emphasize the intentions behind the initial research inputs and to construct a possible sequence of events that will lead to significant levels of impact. It provides a way of helping to analyze the various complex interactions involved in creating impact, including those between investment in research, research results, adoption of results, and various peripheral factors such as production conditions, markets, culture, behavior, and so on. Although it builds on a set of logical relationships that are interlinked in a chainlike manner, it does not imply a linear cause-and-effect contribution to impact. Rather, it explicitly acknowledges the feedback mechanisms and effects of synergy that can lead to impact within innovation systems. Strict application of the impact pathway concept implies that when planning research, one should take into account the often uncontrollable factors that determine impact, for example by consulting widely with farmers and other possible end-users of the research to determine if and how the results are likely to be used.

The impact pathway concept is based on various approaches to evaluation and impact assessment (e.g., Peterson and Horton 1993; Brown and Svenson 1988). A generic model of the research impact pathway is shown in figure 3, which indicates the easily observed steps in the impact pathway (i.e., at the input, output, outcome, and impact levels). As one proceeds along the impact pathway, away from the initial (research) process, the observed changes become less and less attributable to this initial process. At the same time, the number and variety of participants—and hence the probability of conflict—increases.

Three processes may be distinguished on the pathway leading from agricultural research to impact (see also Hartwich and Meijerink 1999).

The research process. Research activities (which may be conducted in the field, in laboratories, in experimental plots, or in offices), use various inputs (e.g., information and human,

Figure 3. The impact pathway model



physical and financial resources) in a *research process* that generates outputs in accordance with set priorities and objectives. Outputs are the measurable products of the research process, such as technologies generated, improved, and adapted; procedures, methods and patents developed; scientific papers written; or simply new information generated. Together, they indicate the production of new and more advanced knowledge.

The innovation process. Once outputs have been generated by the research process, the *innovation process* becomes important, i.e., the dissemination of information and the application of the research outputs. The outcome of this process is the adoption of technologies or the acquisition of knowledge by new users. Outcomes can usually be measured in terms of increases in yield, productivity, and/or production.

Agricultural development process. The *agricultural development process* determines if, after adoption of an innovation, impacts such as increased farm income, increased food security, increased environmental sustainability or increased welfare are realized. Whether or not such impacts are achieved will depend very much on the condition of the rural economy and the prevailing social context.

One of the principal insights revealed by the impact pathway perspective is that development does not flow unerringly through such routes. Researchers and managers should be aware that although they can control the research process, they have no control over the innovation and agricultural development processes. Since these processes are also important to the success of a research operation, they should be taken into account at the research planning and priority setting stage. Understanding the various steps of the impact pathway and applying this knowledge at all stages are crucial elements in becoming more impact oriented.

4. Putting Impact Orientation into Practice

A research organization can be considered *oriented towards impact* when efforts at achieving impact are reflected in all of its activities, including project work, methodology development, testing, dissemination of results, administration and management. All members of an organization should therefore assume some responsibility for the organization's efforts in this direction. In order to do so, it is important that all staff understand how research services contribute to development pathways. As Bellamy (2000) put it: "to be fully effective as part of the development process, an institution develops an impact culture" or, in other words, impact orientation is the application of the total quality management philosophy to a research organization.

Institutionalizing impact orientation implies applying information on development processes and the results of individual impact studies to (1) the identification of research needs, priority setting and planning and (2) managerial decision making and resource allocation processes. Institutionalization of impact orientation can occur at three levels: (1) research management, (2) research staff, and (3) the organizational culture as a whole. Within these levels there are a number of mechanisms that can lead to impact orientation:

- **Sensitizing researchers with regard to how impact is achieved.** Impact orientation requires a common understanding of how impact is achieved (e.g., by using the impact pathway model). Deficiencies in staff understanding can be tackled through capacity building exercises and by fostering the analytical skills associated with impact evaluation. Capacity building activities can, for example, include one-day practical workshops using case studies to illustrate how impact has been achieved in the past. Another valuable approach would be to conduct group exercises in impact-mapping, particularly if stakeholders are able to participate.

- **Institutionalizing impact orientation at the project level.** Most research is planned in the form of projects. Impact orientation at this level can be fostered by making obligatory some or all of the following criteria for project funding: participatory planning, estimation of the likelihood of success, analysis of constraints on impact, application of logframe methodology, and mechanisms for monitoring changing conditions for achieving impact.

- **Ensuring that the results of impact evaluation studies are used effectively.** Information from evaluation studies of all kinds can be used to guide research. The results of such studies should be automatically fed back to researchers, managers, and other stakeholders. Even if a particular research project has already been completed, the results of the associated impact study can still provide information relevant to other projects.

- **Integrating impact evaluation into existing planning, monitoring and evaluation exercises.** Impact evaluation should not be separated from other planning, monitoring, and evaluation exercises. If such activities are conducted regularly, it should not be difficult to include criteria such as the likelihood of research success, the probability of achieving particular impacts, the likelihood of changing market conditions, and analysis of uncontrollable constraints on achieving impact. Impact evaluation should be part of a research management information system, with methodologies and procedures adapted to local needs and capacity.

- **Increasing orientation towards user needs.** Users of research results, such as farmers, processors, and consumers, should not only be included in research design, planning, and priority setting, but should also actively participate in the research process and in testing the utility and applicability of research results. Such user participation will improve researchers' understanding of users' aims and needs.

- **Ensuring external feedback.** Researchers must acknowledge the fact that research is only one factor among many that bring about change, and should be encouraged to question the extent to which their research actually contributes to development. This can be achieved via greater interaction with stakeholders and by distributing and dis-

cussing external reviews and other feedback on their research work. Management should facilitate this process by cultivating external contacts and organizing feedback from various levels, including farmers, other members of the rural community, government officials, and representatives of the private sector.

Conclusions

It is difficult to determine the true impact of agricultural research, and impact evaluation should not be viewed simply as a matter of applying sophisticated evaluation tools. Impact evaluation alone, although important, is not sufficient—it is just one (albeit important) element in an organization's overall orientation towards improving the impact of its activities.

Impact orientation implies both a thorough understanding of the way in which significant impact can be achieved, and ensuring that this knowledge is incorporated into research planning, so that resources are allocated to those areas likely to produce the highest levels of impact. As such, impact orientation is complementary to the economic impact assessment procedures that are often used to justify investments in agricultural research.

Impact orientation employs various impact evaluation methods as well as concepts—such as the impact pathway—that examine how cause-and-effect relationships can influence the attainment of impact. In developing countries in particular, impact orientation should rely not so much on sophisticated and costly impact evaluation methods but rather on easy-to-understand and easy-to-conduct techniques such as impact-mapping, adoption studies, and process evaluation. Such techniques will quickly identify any constraints on achieving impact—both those under the control of research administrators and those beyond their control.

Researchers and research administrators must appreciate that their well-planned research activities may not necessarily lead to impact. Systematically reviewing all available information on how impact has been achieved in other projects in agricultural research will allow them to identify both those research topics most likely to lead to impact, and those that should be abandoned because they are unlikely to produce significant impacts. Other organizations involved in agricultural development will have to assume similar responsibilities and analyze how they, in their turn, can better contribute to agricultural development.

In short, "impact orientation" refers to a change in attitude that in turn entails a change in the organizational culture of a research organization. It can be achieved by various means, including sensitizing researchers, using impact orientation considerations as criteria for research funding decisions, using the results of impact evaluation studies, integrating impact evaluation into other planning, monitoring and evaluation exercises, ensuring the participation of the end users of research, and soliciting external feedback. As mentioned earlier, impact orientation also implies that, if the probability of achieving high levels of impact is low, steps must be taken either to remove any identified constraints or to abandon particular research activities. Ultimately, all activities in a research organization must be conducted in such a way as to increase the overall chances of achieving significant levels of impact.

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